

# PATENT ABSTRACTS OF JAPAN

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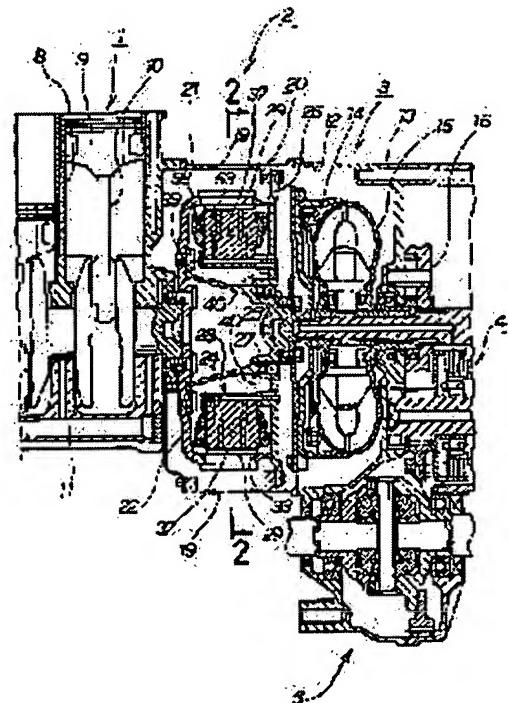
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## (54) COOLING CONSTRUCTION FOR MOTOR

### (57)Abstract:

**PROBLEM TO BE SOLVED:** To efficiently cool a stator and a rotor by providing an air inlet and an air outlet in a motor housing and opening air passages from the center of rotation to radial direction of the motor for the stator and rotor housed in the motor housing.

**SOLUTION:** A generator-motor 2 comprises a motor housing 20 equipped with air outlets 19... (... means plurality), a cup type rotor 22, a stator 22, a housing cover 26 and a bearing 27. The rotor 22 is equipped with a predetermined number of magnets 29... on the internal peripheral surface and a plurality of air passages 33... penetrating between the inside and the outside. Also, the housing cover 26 is equipped with air inlets 40... in the central portion. Then, the rotor 22 begins to rotate together with a crank shaft 11, outside air enters into the air inlets 40... through an air inlet 12 at the side of mission 3, and this air passes through air passages 33... from air passages 53... at the side of stator 24 and moves to outside from the air outlets 19 at the side of a housing main body 21. By doing this, forced air cooling becomes possible.



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**CLAIMS****[Claim(s)]**

[Claim 1] Cooling structure of the motor characterized by opening the other air duct from the center of rotation of a motor to the method of the outside of a path in the stator and Rota which prepared air-suction-system opening and an air exhaust port in motor housing, and were contained in motor housing.

[Claim 2] Cooling structure of the motor characterized by having prepared air-suction-system opening and an air exhaust port in motor housing, having contained Rota in motor housing, having contained the stator to this Rota inside, and opening the other air duct in these stators and Rota from the center of rotation of a motor to the method of the outside of a path.

[Claim 3] Cooling structure of the motor according to claim 1 or 2 characterized by forming the air duct of a stator by carrying out the combination laminating of the being [ a steel plate which constitutes the coil iron core of said stator from a laminate of two or more sheets, and has a notch slot, and a notch slot ] steel plate suitably.

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**DETAILED DESCRIPTION****[Detailed Description of the Invention]**

[0001]

[Field of the Invention] This invention relates to the amelioration technique of the cooling structure of a motor.

[0002]

[Description of the Prior Art] In order for a motor to contain Rota and a stator in motor housing, to pass a current and to rotate Rota, the Joule's heat occurs inevitably on that structure, and it needs to miss this Joule's heat suitably. As the technique, JP,4-317542,A "braking of a car and the cooling system of the induction machine for auxiliary driving gears" is known. According to drawing 1 of this official report, this technique is the oil-injection-type structure of containing an induction machine 2 in housing 32 and 64, supplying oil to these housing 32 and 64, and absorbing generation of heat of an induction machine 2 in this oil.

[0003]

[Problem(s) to be Solved by the Invention] In the above-mentioned oil injection type, a lot of components mark, such as a refrigerant path, seal components, a circulating pump, and a radiator, were also complicated, and it was expensive also in cost. Although the air cooling structure which cools motor housing by the fan every outside is generally adopted, although motor housing is cooled, since the edge has run out, by this method, Rota of that interior and a stator are hard to be cooled on the other hand. Moreover, it was also the cause by which these Rota and a stator maintain a fixed slit, and were supported, the coil front face wound around this stator had usually fixed with resin or a varnish for the cure against waterproofing, or coil coil maintenance, and this barred the heat dissipation effectiveness.

[0004] Then, the purpose of this invention is to offer the cooling structure of the motor which can cool a stator and Rota effectively.

[0005]

[Means for Solving the Problem] In order to attain the above-mentioned purpose, claim 1 prepares air-suction-system opening and an air exhaust port in motor housing, and is characterized by opening the other air duct from the center of rotation of a motor to the method of the outside of a path in the stator and Rota which were contained in motor housing. Air can be cooled directly [ through ] to a stator and Rota, and cooling inside the coil iron core of the stator which is especially a source of generation of heat can be performed. Since the amount of the air which flows into an air duct will also increase and the cooling effect will become large if the rotational frequency of Rota goes up, refrigeration capacity improves.

[0006] Claim 2 prepares air-suction-system opening and an air exhaust port in motor housing, contains Rota in motor housing, contains a stator to this Rota inside, and is characterized by opening the other air duct in these stators and Rota from the center of rotation of a motor to the method of the outside of a path. Air can be cooled directly [ through ] to a stator and Rota, and cooling inside the coil iron core of the stator which is especially a source of generation of heat can be performed. Since the amount of the air which flows into an air duct will also increase and the cooling effect will become large if the rotational frequency of Rota goes up, refrigeration capacity improves. Since Rota was established in the periphery to the stator, a centrifugal force is large, and since the amount of the air which flows into an air duct can also be made [ many ], the cooling effect is still higher.

[0007] Claim 3 constitutes the coil iron core of a stator from a laminate of two or more sheets, and is characterized by forming the air duct of a stator by carrying out the combination laminating of the being [ a steel plate with a notch slot and a notch slot ] steel plate suitably. The coil iron core of a stator is constituted from a laminate of two or more sheets, and since the air duct of a stator was formed by carrying out the combination laminating of the being [ a steel plate with a notch slot and a notch slot ] steel plate suitably, path area is changeable with combination number of sheets. Since an air duct can be formed without using another components, it is cheap.

[0008]

[Embodiment of the Invention] The gestalt of operation of this invention is explained below based on an attached drawing. In addition, a drawing shall be seen to the sense of a sign. Drawing 1 is the important section sectional view of the hybrid car drive-system equipment concerning this invention. Hybrid car drive-system equipment consists of an engine 1, a generator motor 2, missions 3, a clutch 4, and a differential gear 5. Said engine 1 is equipped with a cylinder 8, a piston 9, a connecting rod 10, and a crankshaft 11. Missions 3 consist of the missions housing 13 equipped with the air-suction-system opening 12, torque KOMBATA 15 equipped with the lock-up clutch 14, and an automatic transmission 16.

[0009] A generator motor 2 is the air exhaust port 19. -- ( -- shows plurality.) the following -- being the same -- it consists of a housing cover 26 containing the bearing 25 which fixes the stator 24 contained in the said alignment, and this stator 24 to the interior of the motor housing 20 which it has, Rota 22 of a cup form, and this Rota 22, and bearing 27. In addition, the motor housing 20 serves as the housing body 21 from a housing cover 26.

[0010] Drawing 2 is a sectional view by two to 2 line part of drawing 1, and Rota 22 equips inner skin with piece of guide 34 [ of magnet 29 -- of a predetermined number, two or more air duct 33-- which penetrates inside and outside, and these air duct 33-- ] of plurality [ outlet side ] --. 28 is the shank material of Rota 22. A stator 24 consists of iron core 37 -- constituted from two or more laminates (detail after-mentioned), coil 38-- wound around this iron core 37 --, and bolt 39-- for attaching these in said housing covering 26. Moreover, the housing covering 26 equips a center section with air-suction-system opening 40 --, and is fixed to said housing body 21.

[0011] Drawing 3 is drawing showing the configuration and the assembly point of a laminate concerning this invention. Laminate 35a is "a plate without a notch slot" equipped with a bolthole 42 and the coil coil section 43. Laminate 35b is a bolthole 42, the coil coil section 43, and "the plate with a notch slot" equipped with the other notch slot 44 of U characters from this coil coil section 43 center to above. Laminate 35c is the coil coil section 43 and "the plate with a notch slot" which was equipped with the other abbreviation notch slot 45 for U characters from this coil coil section 43 center to slanting down one, and equipped further this abbreviation notch slot 45 for U characters with \*\*\*\* 48 for bolt penetration of a major diameter from said bolthole 42.

[0012] Drawing 4 (a) - (b) is the assembly drawing of the laminate concerning this invention. (a) is a front view after the assembly of Laminates 35a-35c, and a broken line shows formed air duct 53 --. In addition, like the above-mentioned, from said bolthole 42, since \*\*\*\* 48 for bolt penetration is a major diameter further, even if it lets a bolt 39 pass, there is nothing of laminate 35c-- for which air duct 53 -- is closed. (b) shows two 4b-4b line cross sections after assembly at a time for laminate 35a--, 35b--, 35c--, and 35a--, respectively. Arrow-head \*\*, \*\*, and \*\* show the flow of the air which passes along formed air duct 53 --.

[0013] An operation of the cooling structure of the motor expressed above is explained below. Drawing 5 is the operation explanatory view of the cooling structure of the motor concerning this invention. If a crankshaft 11 rotates, Rota 22 will begin to rotate with this crankshaft 11. This Rota 22 goes into air-suction-system opening 40 -- with which the open air equipped the center section of the housing cover 26 through the air-suction-system opening 12 by the side of missions 3, as a fan's configuration is presented as shown in drawing 2, therefore shown in arrow-head \*\* and \*\*, as that air shows arrow-head \*\*, it passes along air duct 53 -- by the side of a stator 24, and it comes out of it outside through air duct 33 -- of Rota 22 further from air exhaust port 19 -- by the side of the housing body 21. Therefore, forced air cooling of a stator 24 and Rota 22 can be carried out.

[0014] Although the above was an outer rotor mold generator motor with which Rota encloses a stator, the inner rotor mold generator motor with which a stator encloses Rota next is explained. Drawing 6 is another example Fig. of the generator motor concerning this invention. A generator motor 2 consists of a housing cover 26 containing the bearing 25 which fixes to the exterior of the motor housing 20 and the inner rotor 23 of a cup form equipped with air exhaust port 19 --, and this inner rotor 23 the stator 24 contained in the said alignment, and this stator 24, and bearing 27. In addition, the motor housing 20 serves as the housing body 21 from a housing cover 26. The inner rotor 23 equips inner skin with piece of guide 34 [ of magnet 29 -- of a predetermined number, two or more air duct 33-- which penetrates inside and outside, and these air duct 33-- ] of plurality [ outlet side ] --. 28 is the shank material of the inner rotor 23. A stator 24 consists of iron core 37 -- constituted from two or more laminates, coil 38-- wound around this iron core 37 --, and bolt 39-- for attaching these in said housing covering 26. In addition, the motor housing 20 serves as the housing body 21 from a housing cover 26. That is, this example Fig. is the inner rotor mold generator motor of the place of the structure which has arranged Rota (inner) 23 inside to a stator 24.

[0015] Drawing 7 is the modification Fig. of drawing 3. Laminate 35a is "a plate without a notch slot" equipped with a bolthole 42 and the coil coil section 43. Laminate 35b is a bolthole 42, the coil coil section 43, and "the plate with a notch slot" equipped with the other notch slot 44 of U characters from this coil coil section 43 center to above.

Laminate 35c is a bolthole 42, the coil coil section 43, and "the plate with a notch slot" that equipped the right end of the other notch slot 49 of U characters, and this U character notch slot 49 with the cut section 50 from this coil coil section 43 center to down.

[0016] Drawing 8 is the sectional view of the generator motor constituted from a modification of the laminate shown in drawing 7 concerning this invention. A generator motor 2 consists of a stator 24 contained in the said alignment inside the motor housing 20 equipped with air exhaust port 19 --, Rota 22 of a cup form, and this Rota 22, and a housing cover 26 which fixes this stator 24. In addition, the motor housing 20 serves as the housing body 21 from a housing cover 26. Rota 22 equips inner skin with piece of guide 34 [ of magnet 29 -- of a predetermined number, two or more air duct 33-- which penetrates inside and outside, and these air duct 33-- ] of plurality [ outlet side ] --. 28 is the shank material of Rota 22. A stator 24 consists of two or more laminate 35a--, 35b--, iron core 37-- constituted from 35c-- and coil 38-- wound around this iron core 37 --, and bolt 39-- for attaching these in said housing covering 26. Moreover, the housing covering 26 equips a center section with air-suction-system opening 40 --, and is fixed to said housing body 21. This modification shows the example of separate \*\*\*\*\* for a bolthole 42 and air duct 54 -- formed in the U slots 44 and 49, and shows the example of separate \*\*\*\*\* for laminate 35a--, and a bolthole 42 and air duct 54 -- formed in the U slots 44 and 49 by equipping with opening with this air duct 54 -- broad to airstream inlet-port 54a-- 35b-- and air duct 54-- constituted from 35c--.

[0017] In addition, in the gestalt of operation of this invention, although shown as a generator motor in hybrid car drive-system equipment, this invention is the technique which does not restrict to the above-mentioned generator motor, crosses to a motor, a generator at large, etc., and can be used. For example, concomitant use with the thing of the thing of the air-cooling structure which used the fan, water-cooled structure, or oil-quenching structure is also possible. Moreover, it can be used also for the outer rotor mold shown in the important section sectional view of the hybrid car drive-system equipment concerning this invention of drawing 1, or the inner rotor mold shown in another example Fig. of the generator motor concerning this invention of drawing 6.

[0018]

[Effect of the Invention] This invention demonstrates the following effectiveness by the above-mentioned configuration. Claim 1 prepared air-suction-system opening and an air exhaust port in motor housing, and the other air duct was opened in the stator and Rota which were contained in motor housing from the center of rotation of a motor to the method of the outside of a path. Therefore, air can be cooled directly [ through ] to a stator and Rota, and cooling inside the coil iron core of the stator which is especially a source of generation of heat can be performed. Moreover, since the amount of the air which flows into an air duct will also increase and the cooling effect will become large if the rotational frequency of Rota goes up, refrigeration capacity improves.

[0019] Claim 2 prepared air-suction-system opening and an air exhaust port in motor housing, contained Rota in motor housing, contained the stator to this Rota inside, and opened the other air duct in these stators and Rota from the center of rotation of a motor to the method of the outside of a path. Therefore, air can be cooled directly [ through ] to a stator and Rota, and cooling inside the coil iron core of the stator which is especially a source of generation of heat can be performed. Moreover, since the amount of the air which flows into an air duct will also increase and the cooling effect will become large if the rotational frequency of Rota goes up, refrigeration capacity improves. Furthermore, since Rota was established in the periphery to the stator, a centrifugal force is large, and since the amount of the air which flows into an air duct can also be made [ many ], the cooling effect is still higher.

[0020] Claim 3 constituted the coil iron core of a stator from a laminate of two or more sheets, and the air duct of a stator was formed by carrying out the combination laminating of the being [ a steel plate with a notch slot and a notch slot ] steel plate suitably. Therefore, since the air duct of a stator was formed by carrying out the combination laminating of the being [ a steel plate with a notch slot and a notch slot ] steel plate suitably, path area is changeable [ the coil iron core of a stator is constituted from a laminate of two or more sheets, and ] with combination number of sheets. Moreover, since an air duct can be formed without using another components, it is cheap.

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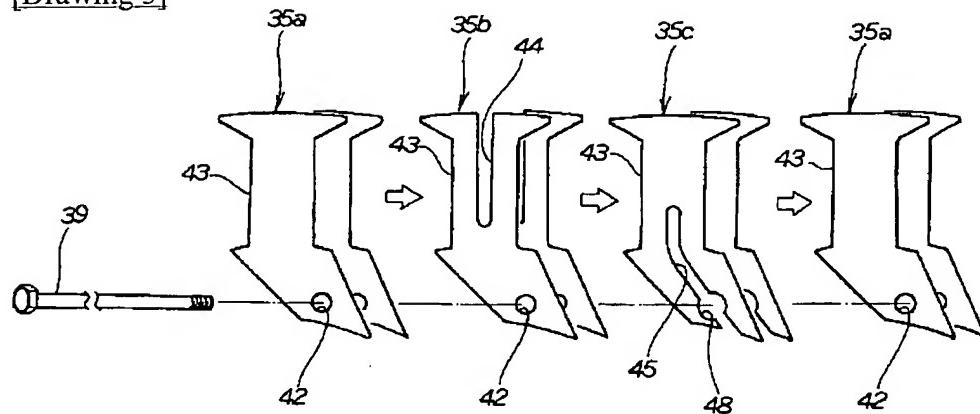
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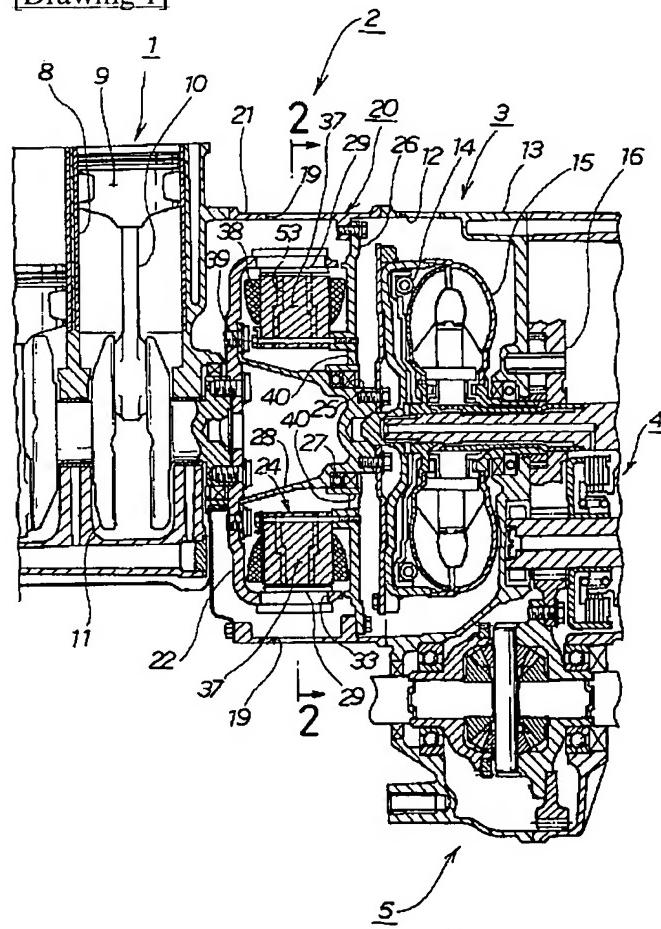
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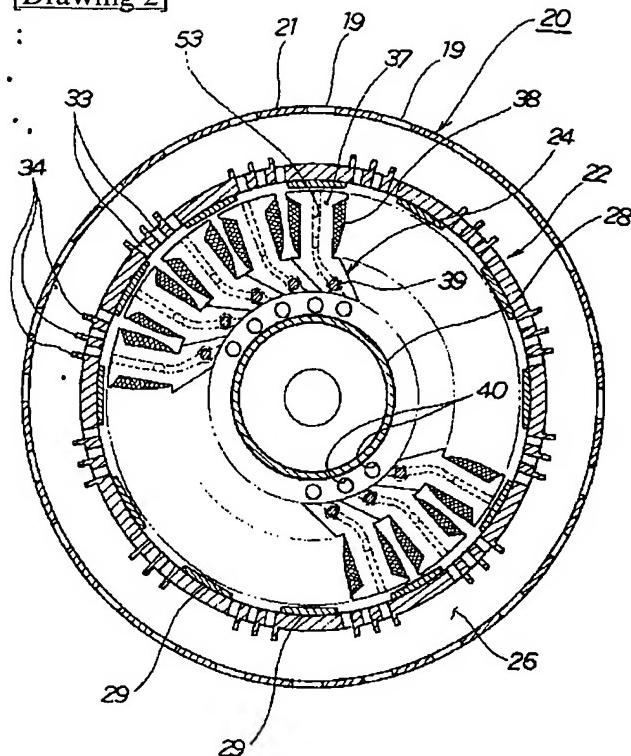
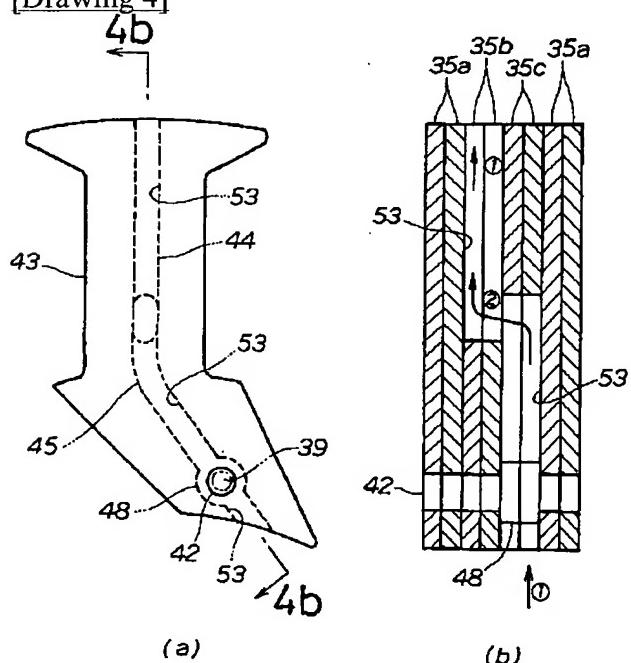
## DRAWINGS

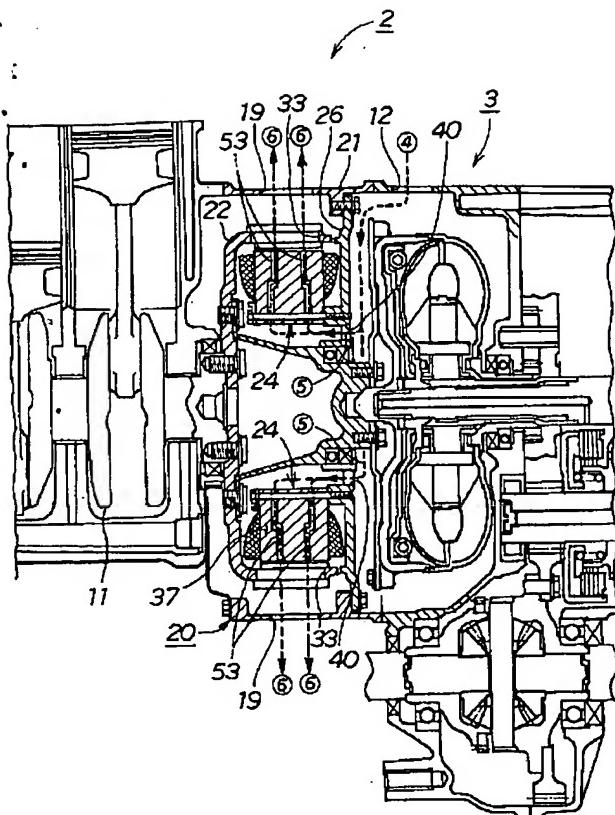
### [Drawing 3]



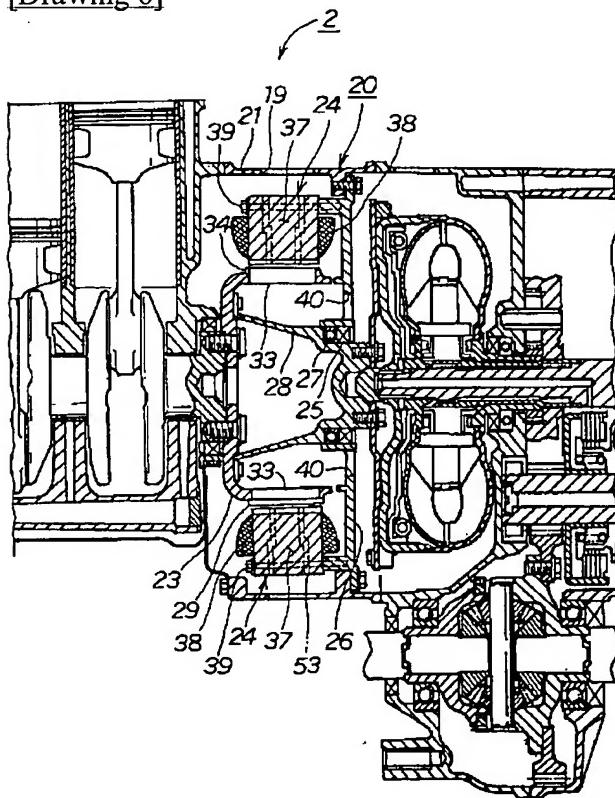
[Drawing 1]



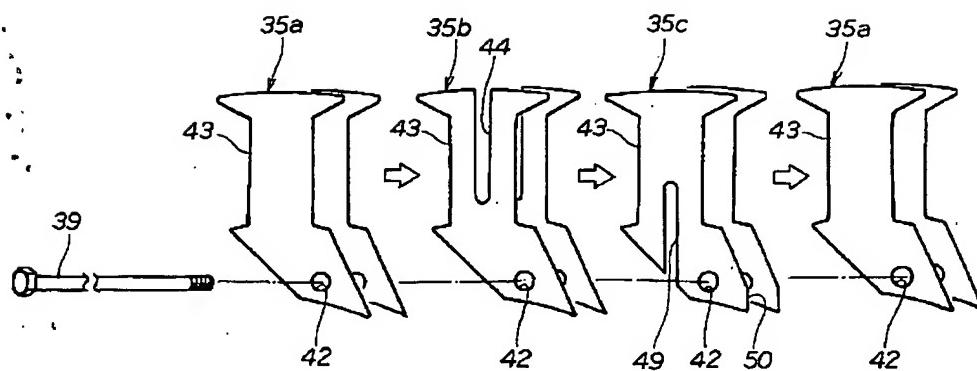
[Drawing 2][Drawing 4][Drawing 5]



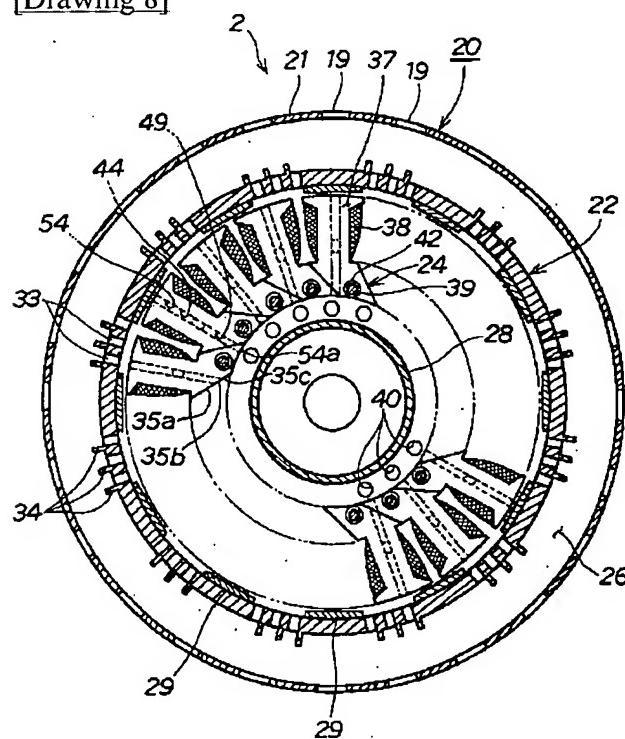
[Drawing 6]



[Drawing 7]



[Drawing 8]



[Translation done.]